Name: Period:

STEAM Critical Zone Investigation Unit

**Critical Zone** -- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ outer \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* Zone where \_\_\_\_\_\_\_\_\_\_\_\_\_\_ meets \_\_\_\_\_\_\_\_\_\_\_\_\_\_
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ layer from \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the trees to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

of groundwater

* Environment where rock, \_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_, air, and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

interact and shape the Earth’s \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* Regulates \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and availability of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Part A) Critical Zone operates on** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ timescales

* Imprinted by important \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Happens over seconds, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, years, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ time

* Short-term responses
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Long term responses – over \_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Part B) Critical Zone processes** \_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* Supports all \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ life
* Determines the availability of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, such as \_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* Benefits to ecosystems also include \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ processes

**Part C) \_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** on the Critical Zone are large and vice versa

* Examples of two important human impacts are \_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_ and

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ use

* Other issues are \_\_\_\_\_\_\_\_\_\_\_\_\_ quality, stream \_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_,

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ transport, and the \_\_\_\_\_\_\_\_\_\_\_\_\_\_ cycle

**Part D) The Critical Zone is not well \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ or is poorly \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

* Three fundamental questions that need answered are:
  + How does the Critical Zone \_\_\_\_\_\_\_\_\_\_\_\_\_?
  + How does it \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_?
  + How will it \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_?
* Understanding the complex \_\_\_\_\_\_\_\_\_ of physical, chemical, and biological processes

requires a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ approach across a broad array of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Watershed Information**

* Area of \_\_\_\_\_\_\_\_\_\_\_\_\_\_ that drains into a body of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Boundaries are determined by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the land

surrounding that \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_, or \_\_\_\_\_

* **Riparian zone** – area of \_\_\_\_\_\_\_\_\_\_\_\_\_\_ along \_\_\_\_\_\_\_\_\_\_\_\_\_\_ (creek \_\_\_\_\_\_\_\_\_\_)
* **Canopy cover** -- \_\_\_\_\_\_\_\_\_\_\_\_\_\_ extending \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ over the stream
  + Canopy cover is important because:
* Blocks \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_ plant growth
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_ the stream
* Provides \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ material
* **Effects of runoff:**
  + Water falls upon \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_ into streams, lakes,

or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* + Necessary to \_\_\_\_\_\_\_\_\_\_\_\_\_ the many \_\_\_\_\_\_\_\_\_\_\_\_\_\_ habitats that depend

on \_\_\_\_\_\_\_\_\_\_ of water for \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ way that water \_\_\_\_\_\_\_\_\_\_\_\_ from one location to

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* + Main way \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ enter waterways
    - **Point source pollution --** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ can be traced back to a

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ location

* + - **Nonpoint source pollution** -- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ where \_\_\_\_\_\_\_\_\_

points are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to locate

* + - * Examples: Garden \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ oils,

transmission \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_, and exhaust

**Water Quality** – conditions of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ with reference to the

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, chemical, and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ characteristics that are

suitable for a particular \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Name: Period:

STEAM Critical Zone Investigation Unit KEY

**Critical Zone** – Earth’s outer skin

* Zone where rock meets life
* Permeable layer from tops of the trees to bottom of groundwater
* Environment where rock, soil, water, air, and organisms interact and shape the Earth’s surface
* Regulates habitat and availability of resources

**Part A) Critical Zone operates on** second-eon timescales

* Imprinted by important events
  + Happens over seconds, hours, years, milennia, and geologic time
* Short-term responses
  + Rainfall, human activities
* Long term responses – over time
  + Climate change and tectonic change

**Part B) Critical Zone processes** sustain life on Earth

* Supports all terrestrial life
* Determines the availability of resources, such as food production and water quality
* Benefits to ecosystems also include hydrologic, geochemical, and geomorphic processes

**Part C)** Human Impacts on the Critical Zone are large and vice versa

* Examples of two important human impacts are climate change and land use
* Other issues are soil quality, stream flow, runoff, contaminant transport, and the carbon cycle

**Part D) The Critical Zone is not well** characterized **or is poorly** understood

* Three fundamental questions that need answered are:
  + How does the Critical Zone form?
  + How does it function?
  + How will it change in the future?
* Understanding the complex web of physical, chemical, and biological processes

requires a systems approach across a broad array of sciences

**Watershed Information**

* Area of land that drains into a body of water
* Boundaries are determined by guiding contours of the land surrounding that stream, river, lake, or bay
* **Riparian zone** – area of land along stream (creek side)
* **Canopy cover** -- plants extending outward over the stream
  + Canopy cover is important because:
* Blocks sunlight and blocks plant growth
* Shades and cools the stream
* Provides organic material
* **Effects of runoff:**
  + Water falls upon surface and runs into streams, lakes, or rivers
  + Necessary to renew the many aquatic habitats that depend on inflow of water for continuity
  + Dominant way that water flows from one location to another
  + Main way pollutants enter waterways
    - **Point source pollution --** source can be traced back to a specific location
    - **Nonpoint source pollution** -- contaminants where entry points are difficult to locate
      * Examples: Garden insecticides, automobile oils,

transmission fluids, paints, and exhaust

**Water Quality** – conditions of the water with reference to the physical, chemical, and biological characteristics that are suitable for a particular purpose